

# Modeling Strategies to Understand Economic and Sociocultural Determinants of Market Participation in a Hawaiian Fishery

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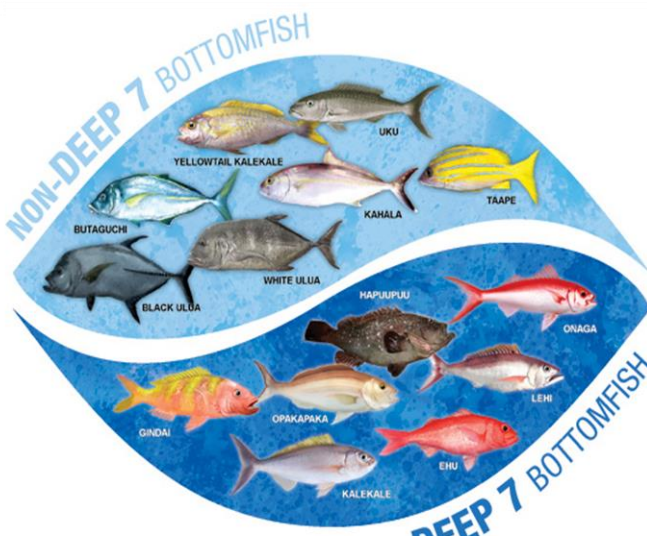
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## Understanding market participation is important

- In the State of Hawaii there are minimal licensing or reporting requirements for fishermen that do not sell fish
- Ease of market access and informal means to sell fish (friends, coworkers) often goes unreported and complicates management
- There are concerns of underreporting from fishermen who sell fish
- A refined understanding of market participation can improve stock assessments
- This research provides the first quantitative approach to explore the economic and social determinants of market participation (selling fish) in a small boat fishery in Hawaii, with a specific application to the main Hawaiian Islands bottomfish fishery

## The Main Hawaiian Islands bottomfish fishery is a unique fishery to explore

The Hawaii bottomfish fishery is a complex mix of commercial, recreational, cultural, and subsistence fishermen whose artisanal fishing behavior, cultural motivations for fishing, and rates of market participation does not align well with legal and regulatory frameworks. Additionally, participants are disproportionately Native Hawaiian (24%) relative to the general population (9%).

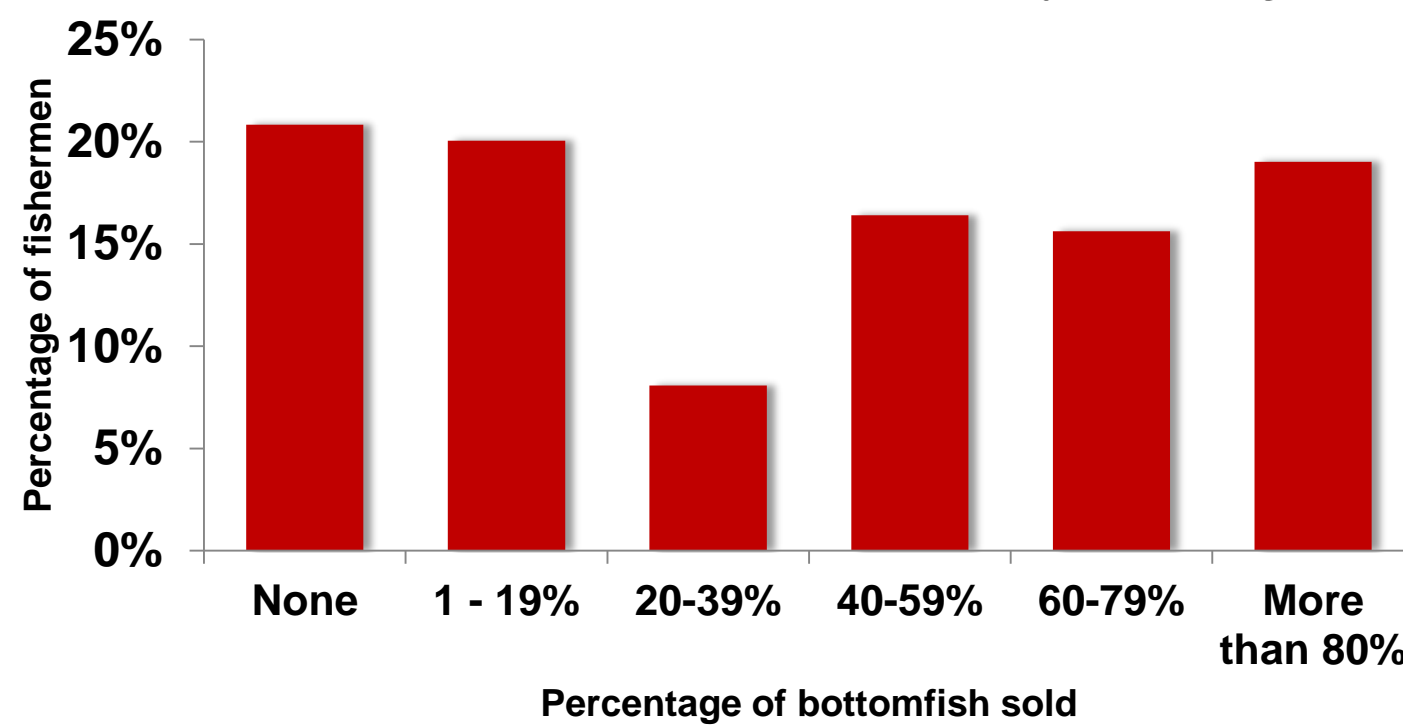


The Hawaii bottomfish complex consists of 14 species of snapper, grouper, and jacks

What do you do with your catch?



In the past 12 months how much fish did you sell?



Traditional onaga wedding presentation

A hook-and-line fishery that targets fish in deep-slope habitat between 50-200 fathoms

Are the bottomfish you catch an important source of food for your family?

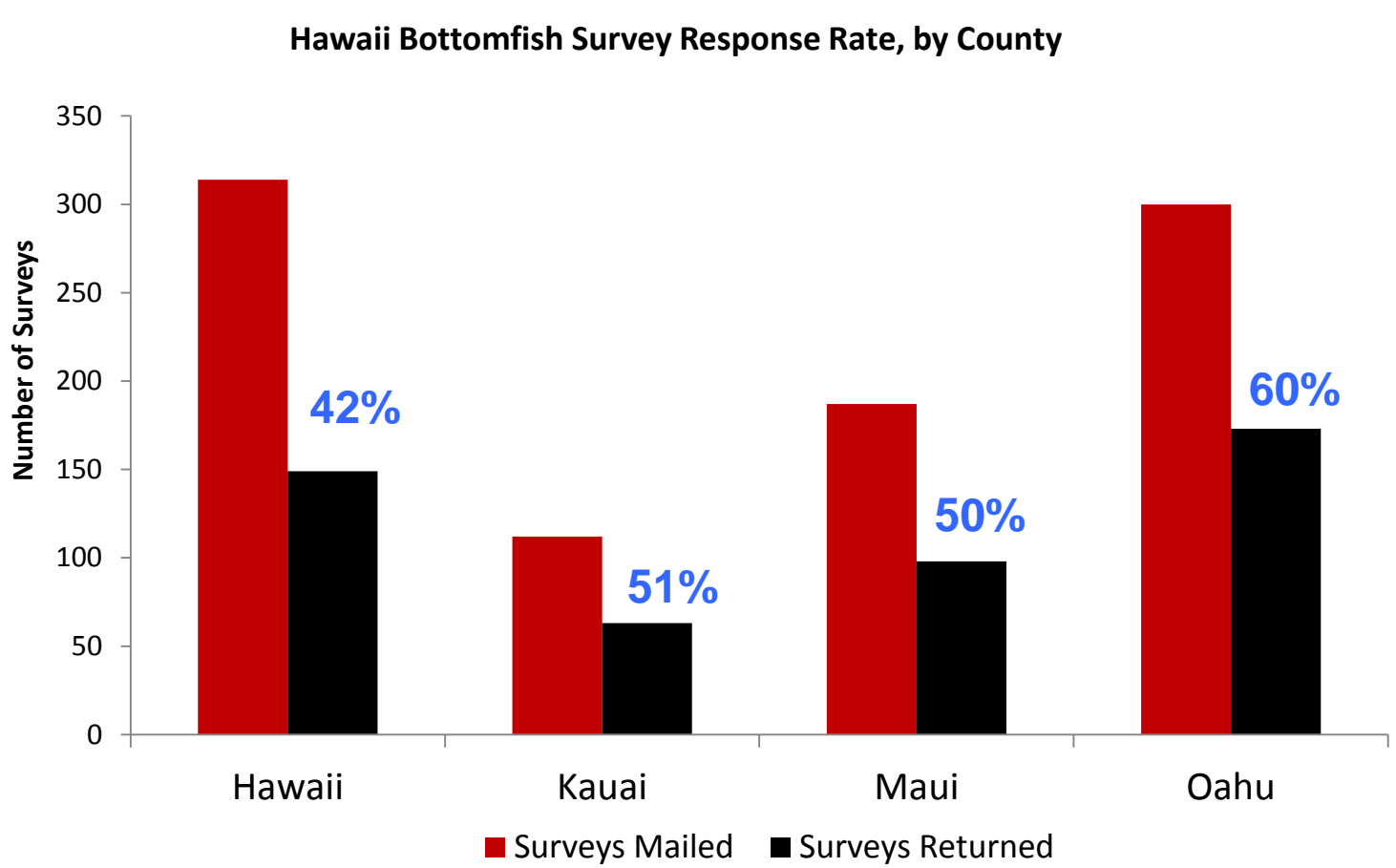
64% say YES

Kauai 67% Maui 79% Oahu 53% Hawaii 69%

The scale of market participation is diverse across the fleet

## Input from fishermen were integrated with statistical methods

- Data come from a mail survey of commercially-licensed bottomfish fishermen in 2010
- 1012 surveys distributed 519 fishermen responded (51% response)
- The sample reflects diversity of the fleet



## Estimation Methods

This research seeks to explain the scale of market participation in this fishery with the dependent variable being the percentage of bottomfish sold. The data included a high percentage of zero observations which requires methodological considerations. For this reason multiple modeling techniques sufficient for these data were utilized.

### Tobit

$$y^* = \beta_0 + \mathbf{x}\beta + u, u | \mathbf{x} \sim \text{Normal}(0, \sigma^2)$$
$$y = \max(0, y^*)$$

### Generalized Linear Model

$$E(y_i | \mathbf{x}_i) = G(\mathbf{x}_i \beta)$$

where  $G(\cdot)$  is a known function satisfying  $0 < G(\cdot) < 1$

$$G(\cdot) = \frac{\exp(z)}{1 + \exp(z)}$$

### Ordered Logistic

$$y_i^* = \beta_0 + \mathbf{x}_i \beta + u_i$$
$$y_i = 0 \text{ if } \mu_1 < y_i^* \leq \mu_0$$
$$y_i = 1 \text{ if } \mu_0 < y_i^* \leq \mu_1$$
$$y_i = 2 \text{ if } \mu_1 < y_i^* \leq \mu_2$$
$$\vdots$$
$$y_i = J \text{ if } \mu_{J-1} < y_i^* \leq \mu_J$$

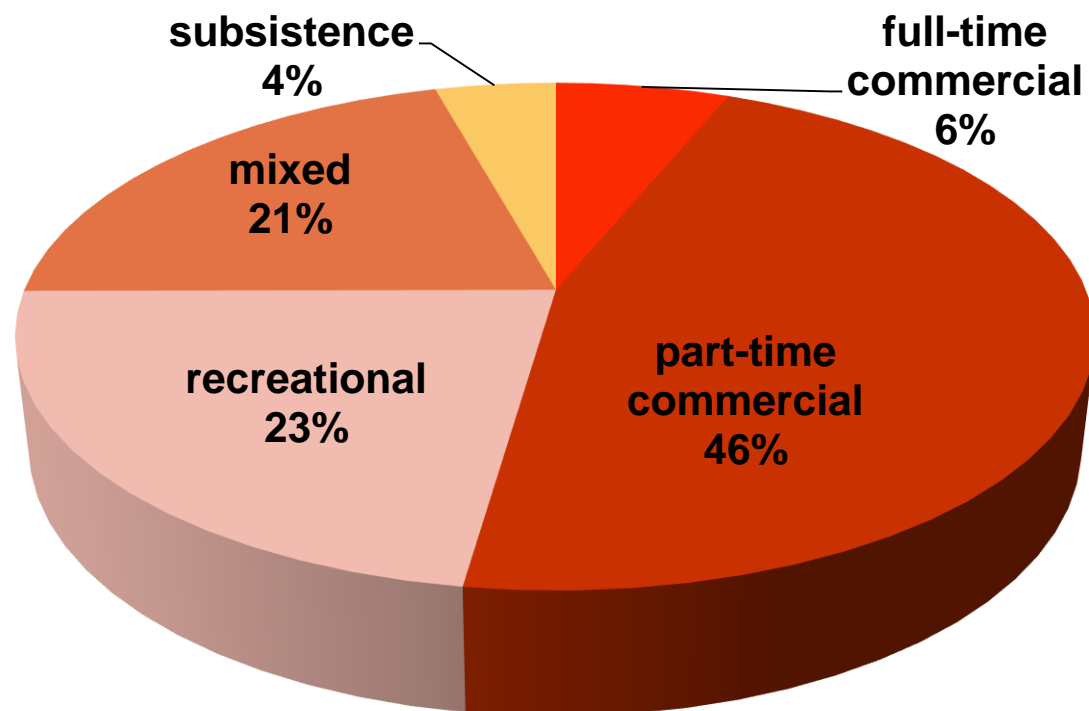
- Market participation is modeled to be a function of
  - Trip costs (*fuel, ice, bait, food and beverage, etc.*)
  - Self-classification responses which reflect fisher motivation
  - Sociocultural attributes (*fish as food, island of residence*)
  - Demographics (*education, income, age, ethnicity*)

## Results are robust to multiple assumptions: fisher perceptions have predictive power

The results are shown to be robust across multiple modeling strategies including jackknifed samples.

- WEAK support for *Cost Recovery* hypothesis – Trip costs are positive and significant factor, but very small marginal effect and influence declines as other factors are considered.
- STRONG support for *Sociocultural* hypothesis – Attributes were significant with a priori signs.
  - Fishermen who *primarily* target bottomfish sell more than fishers who occasionally fish for bottomfish
  - When bottomfish is an *important source of food*, fishermen sell less than those who do not view bottomfish as an important food source
  - Island effects are significant with Oahu and Kauai fishermen selling less than Big Island fishermen. No significant difference between Maui and Big Island fishermen
- STRONG support for *Motivation (Self-Classification)* hypothesis – Significant determinant of market participation with clear distinctions across groups

How would you classify yourself as a fisherman?



A “full-time commercial” fisherman, all else fixed, sells nearly 63% more than a self-defined “recreational” fisherman

A “part-time commercial” fisherman, all else fixed, sells about 42% more fish relative to a “recreational” fisherman

A “mixed motivation” fisherman sells nearly 20% more than a strictly “recreational” fisher

## Fisher perceptions could improve fishery monitoring and assessment

- This research provides evidence that fisher self-perceptions could prove to be a useful determinant of fisher behavior and utilized by fishery managers to better understand issues related to catch reporting and monitoring in Hawaii small boat fisheries.
- These findings may help managers predict factors that could affect future levels of market participation, which would subsequently impact effort levels in the fishery and likewise catch reporting.
- These results could also stimulate attempts to integrate self-classification data into existing monitoring programs in other small boat fisheries to improve performance.
- This research could have important implications for future monitoring, management, valuation, and allocation of local fishery resources.
- Pacific Islands fisheries are important for sustaining social and community networks, perpetuating fishing traditions, and providing fish to local communities as a source of food security.

Photos courtesy of Kurt Kawamoto and Ed Watamura

For questions, final results, or a list of references, please contact: Justin.Hospital@noaa.gov

